

FEATURES

- 32-bit Post-Processor Audio DSP supports Multichannel Dolby[®] Volume
- Programmable through DSP Composer[™]
- CS49DV8, supports up to 7.1 Channels of Dolby Volume processing at 48 kHz, 44.1 kHz or 32 kHz.
 - Input Configurable for all input/output digital audio types (I²S, LJ/RJ, and TDM)
 - 32-bit data path delivers uncompromised dynamic range
 - 192 kHz capable integrated S/PDIF transmitter
 - DAO can operate in master or slave mode (SCLK & LRCLK)
- Integrated Clock Manager/PLL
 - Capable of operating from a wide variety of external crystals or external oscillators
- · Input Fs Auto Detection, Reporting and Handling
- · Sample rate conversion.
- Master & Slave Host Boot Capability via Serial Interface
- SPI interface capable of running up to 25 MHz during run time
- 1.8V Core and a 3.3V I/O that is tolerant to 5V input

32-bit Dual Audio DSP Engine featuring Multichannel Dolby® Volume

The new CS49DV8C is the fastest time-to-market, mass-production ready Multichannel Dolby Volume solution available. The target applications for the CS49DV8C DSP are:

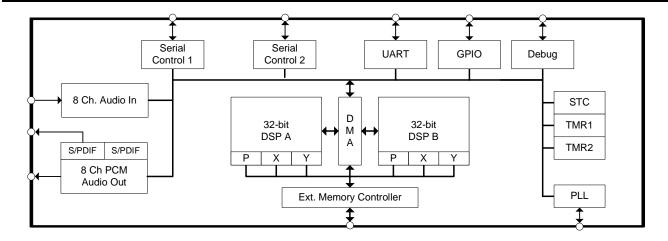
- Soundbars
- DTVs with Integrated Soundbars
- HDTV Stands/Furniture with Integrated Soundbars
- Automotive Head Units
- Automotive Outboard Amplifiers
- Blu-ray Disc[®] & DVD Receivers / HTiBs

All of these applications and many more that use volume control and are subject to playback from sources that do not have consistent volume levels will benefit from the CS49DV8C Dolby Volume solution.



Ordering Information

See page 27 for ordering information.



Preliminary Product Information

This document contains information for a new product. Cirrus Logic reserves the right to modify this product without notice.





Contacting Cirrus Logic Support

For all product questions and inquiries contact a Cirrus Logic Sales Representative. To find the one nearest to you go to www.cirrus.com.

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Table of Contents

2. Overview 2. 1 Licensing 3. Firmware Supported 4. Hardware Functional Description 4.1 DSP Core 4.1.1 DSP Memory 4.1.2 DMA Controller 4.2 On-chip DSP Peripherals 4.2.1 Digital Audio Input Port (DAI) 4.2.2 Digital Audio Input Port (DAI) 4.2.3 Serial Control Port 1 & 2 ((² C [©] or SPI ^{**}) 4.2.4 External Memory Interface 4.2.5 GPIO 4.2.6 PLL-based Clock Generator 4.3 DSP I/O Description 4.3.1 Multiplexed Pins 4.3.2 Termination Requirements 4.3.3 Pads 4.3.3 Pads 4.4 Application Code Security 5. Characteristics and Specifications 15.1 Absolute Maximum Ratings 15.2 Recommended Operating Conditions 15.3 Digital DC Characteristics 15.4 Power Supply Characteristics 15.5 Thermal Data (122-Pin LOFP) 15.6 Switching Characteristics — RESET 15.7 Switching Characteristics — RESET 15.8 Switching Characteristics — Internal Clock 15.9 Switching Characteristics — Serial Control Port - SPI Slave Mode 15.10 Switching Characteristics — Serial Control Port - SPI Slave Mode 15.10 Switching Characteristics — Serial Control Port - SPI Slave Mode 15.1 Switching Characteristics — Serial Control Port - SPI Slave Mode 15.1 Switching Characteristics — Serial Control Port - SPI Slave Mode 15.1 Switching Characteristics — Serial Control Port - SPI Slave Mode 15.1 Switching Characteristics — Serial Control Port - SPI Slave Mode 15.1 Switching Characteristics — Serial Control Port - SPI Slave Mode 15.1 Switching Characteristics — Serial Control Port - SPI Slave Mode 15.1 Switching Characteristics — Serial Control Port - SPI Slave Mode 15.1 Switching Characteristics — Serial Control Port - SPI Claver Mode 15.1 Switching Characteristics — Serial Control Port - SPI Slaver Mode 15.1 Switching Characteristics — Serial Control Port - SPI Slaver Mode 15.1 Switching Characteristics — Serial Control Port - SPI Slaver Mode 15.1 Switching Characteristics — Serial Control Port - SPI Slaver Mode 15.1 Switching Characteristics — Spiglial Audio Output Port 15.1 Switching Characteristics — Serial Control Port - SPI Slaver Mode 15.1 Switching Characteristics	1.	. Documentation Strategy	5
2.1 Licensing 3. Firmware Supported 4. Hardware Functional Description 4.1 DSP Core 4.1.1 DSP Memory 4.1.2 DMA Controller 4.2.0 Ch-chip DSP Peripherals 4.2.1 Digital Audio Input Port (DAI) 4.2.2 Digital Audio Output Port (DAO) 4.2.3 Serial Control Port 1 & 2 (I ² C® or SPI") 4.2.4 External Memory Interface 4.2.5 GPIO 4.2.6 SPIO 4.2.6 SPIO 4.2.6 PIL-based Clock Generator 4.3 DSP I/O Description 4.3.1 Multiplexed Pins 4.3.2 Termination Requirements 4.3.3 Pads 4.4 Application Code Security 5. Characteristics and Specifications 1.5.1 Absolute Maximum Ratings 1.5.2 Recommended Operating Conditions 1.5.3 Digital DC Characteristics 1.5.5 Nermal Data (128-Pin LQFP) 1.5.6 Switching Characteristics — RESET 1.5.7 Switching Characteristics — Serial Control Port - SPI Slave Mode 1.5.10 Switching Characteristics — Serial Control Port - SPI Slave Mode 1.5.10 Switching Characteristics — Serial Control Port - SPI Slave Mode 1.5.11 Switching Characteristics — Serial Control Port - SPI Slave Mode 1.5.12 Switching Characteristics — Serial Control Port - SPI Slave Mode 1.5.13 Switching Characteristics — Serial Control Port - SPI Slave Mode 1.5.14 Switching Characteristics — Serial Control Port - I ² C Master Mode 1.5.15 Switching Characteristics — Serial Control Port - I ² C Master Mode 1.5.15 Switching Characteristics — Serial Control Port - I ² C Master Mode 1.5.15 Switching Characteristics — Serial Control Port - I ² C Master Mode 1.5.15 Switching Characteristics — Serial Control Port - I ² C Master Mode 1.5.15 Switching Characteristics — Digital Audio Slave Input Port 1.5.15 Switching Characteristics — Sorial Control Port - I ² C Master Mode 1.5.16 Switching Characteristics — Sorial Control Port - I ² C Master Mode 1.5.15 Switching Characteristics — Sorial Control Port - I ² C Master Mode 1.5.16 Switching Characteristics — Sorial Control Port - I ² C Master Mode 1.5.16 Switching Characteristics — Sorial Control Port - I ² C Master Mode 1.5.15 Switching Characteristics — Sorial Control Port - I ² C Master Mode 1.5.16 Switching C	2.	Overview	5
4.1 DSP Core 4.1.1 DSP Memory 4.1.2 DMA Controller 4.2 On-chip DSP Peripherals 4.2.1 Digital Audio Input Port (DAI) 4.2.2 Digital Audio Note Port (DAI) 4.2.3 Serial Control Port 1 & 2 (12 0° or SPI") 4.2.4 External Memory Interface 4.2.5 GPIO 4.2.6 PLL-based Clock Generator 4.3 DSP I/O Description 4.3.1 Multiplexed Pins 4.3.2 Termination Requirements 4.3.3 Pads 4.4 Application Code Security 5. Characteristics and Specifications 5.1 Absolute Maximum Ratings 5.2 Recommended Operating Conditions 5.3 Digital DC Characteristics 5.5 Thermal Data (128-Pin LQFP) 5.6 Switching Characteristics — RESET 5.7 Switching Characteristics — RESET 5.7 Switching Characteristics — Serial Control Port - SPI Slave Mode 5.10 Switching Characteristics — Serial Control Port - PC SIave Mode 5.11 Systiching Characteristics — Serial Control Port - PC SIave Mode 5.12 Switching Characteristics — Serial Control Port - PC SIave Mode 5.13 Switching Characteristics — Serial Control Port - PC SIave Mode 5.15 Switching Characteristics — Serial Control Port - PC SIave Mode 5.15 Switching Characteristics — Serial Control Port - PC SIave Mode 5.15 Switching Characteristics — Serial Control Port - PC SIAve Mode 5.15 Switching Characteristics — Serial Control Port - PC SIAve Mode 5.15 Switching Characteristics — Serial Control Port - PC SIAve Mode 5.15 Switching Characteristics — Serial Control Port - PC Master Mode 5.15 Switching Characteristics — Serial Control Port - PC Master Mode 5.15 Switching Characteristics — Serial Control Port - PC Master Mode 5.15 Switching Characteristics — Serial Control Port - PC Master Mode 5.16 Switching Characteristics — Serial Control Port - PC SIAve Mode 5.16 Switching Characteristics — Serial Control Port - PC Master Mode 5.16 Switching Characteristics — Serial Control Port - PC Master Mode 5.16 Switching Characteristics — Serial Control Port - PC SIAve Mode 5.16 Switching Characteristics — Serial Control Port - PC SIAve Mode 5.16 Switching Characteristics — Serial Control Port - PC SIAve Mode 5.16 Switching Charact			
4.1 DSP Core 4.1.1 DSP Memory 4.1.2 DMA Controller 4.2 On-chip DSP Peripherals 4.2.1 Digital Audio Input Port (DAI) 4.2.2 Digital Audio Note Port (DAI) 4.2.3 Serial Control Port 1 & 2 (12 0° or SPI") 4.2.4 External Memory Interface 4.2.5 GPIO 4.2.6 PLL-based Clock Generator 4.3 DSP I/O Description 4.3.1 Multiplexed Pins 4.3.2 Termination Requirements 4.3.3 Pads 4.4 Application Code Security 5. Characteristics and Specifications 5.1 Absolute Maximum Ratings 5.2 Recommended Operating Conditions 5.3 Digital DC Characteristics 5.5 Thermal Data (128-Pin LQFP) 5.6 Switching Characteristics — RESET 5.7 Switching Characteristics — RESET 5.7 Switching Characteristics — Serial Control Port - SPI Slave Mode 5.10 Switching Characteristics — Serial Control Port - PC SIave Mode 5.11 Systiching Characteristics — Serial Control Port - PC SIave Mode 5.12 Switching Characteristics — Serial Control Port - PC SIave Mode 5.13 Switching Characteristics — Serial Control Port - PC SIave Mode 5.15 Switching Characteristics — Serial Control Port - PC SIave Mode 5.15 Switching Characteristics — Serial Control Port - PC SIave Mode 5.15 Switching Characteristics — Serial Control Port - PC SIAve Mode 5.15 Switching Characteristics — Serial Control Port - PC SIAve Mode 5.15 Switching Characteristics — Serial Control Port - PC SIAve Mode 5.15 Switching Characteristics — Serial Control Port - PC Master Mode 5.15 Switching Characteristics — Serial Control Port - PC Master Mode 5.15 Switching Characteristics — Serial Control Port - PC Master Mode 5.15 Switching Characteristics — Serial Control Port - PC Master Mode 5.16 Switching Characteristics — Serial Control Port - PC SIAve Mode 5.16 Switching Characteristics — Serial Control Port - PC Master Mode 5.16 Switching Characteristics — Serial Control Port - PC Master Mode 5.16 Switching Characteristics — Serial Control Port - PC SIAve Mode 5.16 Switching Characteristics — Serial Control Port - PC SIAve Mode 5.16 Switching Characteristics — Serial Control Port - PC SIAve Mode 5.16 Switching Charact	3.	Firmware Supported	7
4.1.1 DSP Memory 4.1.2 DMA Controller 4.2 On-chip DSP Peripherals 4.2.1 Digital Audio Input Port (DAI) 4.2.2 Digital Audio Output Port (DAO) 4.2.3 Serial Control Port 1 & 2 (1²C® or SPI™) 4.2.4 External Memory Interface 4.2.5 GPIO 4.2.6 PLL-based Clock Generator 4.3 DSP I/O Description 4.3.1 Multiplexed Pins 4.3.2 Termination Requirements 4.3.3 Pads 4.4.3 Pplication Code Security 5. Characteristics and Specifications 4.3 Dspecifications 5.1 Absolute Maximum Ratings 5.2 Recommended Operating Conditions 5.3 Digital DC Characteristics 5.4 Power Supply Characteristics 5.5 Thermal Data (128-Pin LQFP) 5.6 Switching Characteristics — RESET 5.7 Switching Characteristics — Serial Control Port - SPI Slave Mode 5.1 Switching Characteristics — Serial Control Port - SPI Slave Mode 5.1 Switching Characteristics — Serial Control Port - PC Slave Mode 5.1 Switching Characteristics — Serial Control Port - PC Slave Mode 5.1 Switching Characteristics — Serial Control Port - PC Slave Mode 5.1 Switching Characteristics — Serial Control Port - PC Slave Mode 5.1 Switching Characteristics — Serial Control Port - PC Slave Mode 5.1 Switching Characteristics — Serial Control Port - PC Slave Mode 5.1 Switching Characteristics — Serial Control Port - PC Slave Mode 5.1 Switching Characteristics — Serial Control Port - PC Slave Mode 5.1 Switching Characteristics — Serial Control Port - PC Slave Mode 5.1 Switching Characteristics — Serial Control Port - PC Slave Mode 5.1 Switching Characteristics — Serial Control Port - PC Slave Mode 5.1 Switching Characteristics — Serial Control Port - PC Slave Mode 5.1 Switching Characteristics — Serial Control Port - PC Slave Mode 5.1 Switching Characteristics — Serial Control Port - PC Slave Mode 5.1 Switching Characteristics — Serial Control Port - PC Slave Mode 5.1 Switching Characteristics — Serial Control Port - PC Slave Mode 5.1 Switching Characteristics — Serial Control Port - PC Slave Mode 5.1 Switching Characteristics — Serial Control Port - PC Slave Mode 5.1 Switching Characteristics — Serial Con		• •	
4.1.1 DSP Memory 4.1.2 DMA Controller 4.2 On-chip DSP Peripherals 4.2.1 Digital Audio Input Port (DAI) 4.2.2 Digital Audio Output Port (DAO) 4.2.3 Serial Control Port 1 & 2 (12 € or SPI™) 4.2.4 External Memory Interface 4.2.5 GPIO 4.2.6 PLL-based Clock Generator 4.3 DSP I/O Description 4.3.1 Multiplexed Pins 4.3.2 Termination Requirements 4.3.3 Pads 4.4 Application Code Security 5. Characteristics and Specifications 5.1 Absolute Maximum Ratings 5.2 Recommended Operating Conditions 5.3 Digital DC Characteristics 5.4 Power Supply Characteristics 5.5 Thermal Data (128-Pin LQFP) 5.6 Switching Characteristics — RESET 5.7 Switching Characteristics — Internal Clock 5.9 Switching Characteristics — Internal Clock 5.9 Switching Characteristics — Serial Control Port - SPI Slave Mode 5.1 Switching Characteristics — Serial Control Port - PSP Slave Mode 5.1 Switching Characteristics — Serial Control Port - PSP Slave Mode 5.1 Switching Characteristics — Serial Control Port - PSP Slave Mode 5.1 Switching Characteristics — Serial Control Port - PSP Slave Mode 5.1 Switching Characteristics — Serial Control Port - PSP Slave Mode 5.1 Switching Characteristics — Serial Control Port - PSP Slave Mode 5.1 Switching Characteristics — Serial Control Port - PSP Slave Mode 5.1 Switching Characteristics — Serial Control Port - PSP Slave Mode 5.1 Switching Characteristics — Serial Control Port - PSP Slave Mode 5.1 Switching Characteristics — Serial Control Port - PSP Slave Mode 5.1 Switching Characteristics — Serial Control Port - PSP Slave Mode 5.1 Switching Characteristics — Serial Control Port - PSP Slave Mode 5.1 Switching Characteristics — Serial Control Port - PSP Slave Mode 5.1 Switching Characteristics — Serial Control Port - PSP Slave Mode 5.1 Switching Characteristics — Serial Control Port - PSP Slave Mode 5.1 Switching Characteristics — Serial Control Port - PSP Slave Mode 5.1 Switching Characteristics — Serial Control Port - PSP Slave Mode 5.1 Switching Characteristics — Serial Control Port - PSP Slave Mode 5.1 Switching Charac	4.		
4.1.2 DMA Controller 4.2 On-chip DSP Peripherals 4.2.1 Digital Audio Input Port (DAI) 4.2.1 Digital Audio Input Port (DAI) 4.2.3 Serial Control Port 1 & 2 (120 or SPI") 4.2.4 External Memory Interface 4.2.5 GPIO 4.2.6 PLL-based Clock Generator 4.3.1 Multiplexed Pins 4.3.1 Multiplexed Pins 4.3.2 Termination Requirements 4.3.2 Termination Requirements 4.3.3 Pads 4.4 Application Code Security 5. Characteristics and Specifications 11 5.1 Absolute Maximum Ratings 5.1 Absolute Maximum Ratings 5.2 Recommended Operating Conditions 5.3 Digital DC Characteristics 5.4 Power Supply Characteristics 5.5 Thermal Data (128-Pin LOFP) 5.6 Switching Characteristics — RESET 5.7 Switching Characteristics — TI 5.8 Switching Characteristics — Serial Control Port - SPI Slave Mode 5.10 Switching Characteristics — Serial Control Port - SPI Master Mode 5.12 Switching Characteristics — Serial Control Port - SPI Master Mode 5.13 Switching Characteristics — Serial Control Port - SPI Master Mode 5.15 Switching Characteristics — Serial Control Port - SPI Master Mode 5.15 Switching Characteristics — Serial Control Port - SPI Master Mode 5.15 Switching Characteristics — Serial Control Port - I ² C Slave Mode 5.15 Switching Characteristics — Serial Control Port - I ² C Slave Mode 5.15 Switching Characteristics — Serial Control Port - I ² C Master Mode 5.15 Switching Characteristics — Serial Control Port - I ² C Master Mode 5.15 Switching Characteristics — Serial Control Port - I ² C Master Mode 5.15 Switching Characteristics — Serial Control Port - I ² C Master Mode 5.15 Switching Characteristics — Serial Control Port - I ² C Master Mode 5.15 Switching Characteristics — Serial Control Port - I ² C Master Mode 5.16 Switching Characteristics — Serial Control Port - I ² C Master Mode 5.17 Switching Characteristics — Serial Control Port - I ² C Master Mode 5.18 Switching Characteristics — Serial Control Port - I ² C Master Mode 5.19 Switching Characteristics — Serial Control Port - I ² C Master Mode 5.10 Switching Characteristics — Serial Control Po			
4.2 On-chip DSP Peripherals 4.2.1 Digital Audio Input Port (DAI) 4.2.2 Digital Audio Output Port (DAO) 4.2.3 Serial Control Port 1 & 2 (1²C® or SPI™) 4.2.4 External Memory Interface 4.2.5 GPIO 4.2.6 PILL-based Clock Generator 4.3 DSP I/O Description 4.3.1 Multiplexed Pins 4.3.2 Termination Requirements 4.3.3 Pads 4.4 Application Code Security 5. Characteristics and Specifications 5.1 Absolute Maximum Ratings 5.2 Recommended Operating Conditions 5.3 Digital DC Characteristics 5.5 Thermal Data (128-Pin LQFP) 5.6 Switching Characteristics — RESET 5.7 Switching Characteristics — Serial Control Port - SPI Slave Mode 5.9 Switching Characteristics — Serial Control Port - I²C Slave Mode 1.5.10 Switching Characteristics — Serial Control Port - I²C Master Mode 1.5.12 Switching Characteristics — Serial Control Port - I²C Master Mode 1.5.13 Switching Characteristics — Serial Control Port - I²C Master Mode 1.5.14 Switching Characteristics — Serial Control Port - I²C Master Mode 1.5.15 Switching Characteristics — Serial Control Port - I²C Master Mode 1.5.15 Switching Characteristics — Serial Control Port - I²C Master Mode 1.5.15 Switching Characteristics — Digital Audio Output Port 5.16 Switching Characteristics — Digital Audio Output Port 5.17 Environmental, Manufacturing, and Handling Information 22 8. Device Pin-Out Diagram 23 8. 1128-Pin LQFP Pin-Out Diagram 24 9. Package Mechanical Drawings 25 9. 1128-Pin LQFP Package		•	
4.2.1 Digital Audio Input Port (DAI) 4.2.2 Digital Audio Output Port (DAO) 4.2.3 Serial Control Port 1 & 2 (1²C® or SPI™) 4.2.4 External Memory Interface 4.2.5 GPIO 4.2.6 PLL-based Clock Generator 4.3.5 DSP I/O Description 4.3.1 Multiplexed Pins 4.3.2 Termination Requirements 4.3.3 Pads 4.4 Application Code Security 5. Characteristics and Specifications 4.4 Application Code Security 5. Characteristics and Specifications 5.1 Absolute Maximum Ratings 1.5.3 Digital DC Characteristics 5.4 Power Supply Characteristics 5.5 Thermal Data (128-Pin LOFP) 1.5.6 Switching Characteristics — RESET 5.7 Switching Characteristics — NTI 5.8 Switching Characteristics — Serial Control Port - SPI Slave Mode 1.5.10 Switching Characteristics — Serial Control Port - SPI Slave Mode 1.5.10 Switching Characteristics — Serial Control Port - SPI Master Mode 1.5.12 Switching Characteristics — Serial Control Port - SPI Slave Mode 1.5.13 Switching Characteristics — Serial Control Port - SPI Slave Mode 1.5.13 Switching Characteristics — Serial Control Port - SPI Master Mode 1.5.14 Switching Characteristics — Serial Control Port - SPI Master Mode 1.5.13 Switching Characteristics — Serial Control Port - SPI Slave Mode 1.5.14 Switching Characteristics — Serial Control Port - SPI Master Mode 1.5.15 Switching Characteristics — Serial Control Port - SPI Master Mode 1.5.15 Switching Characteristics — Serial Control Port - SPI Master Mode 1.5.15 Switching Characteristics — Serial Control Port - SPI Master Mode 1.5.15 Switching Characteristics — Serial Control Port - SPI Master Mode 1.5.16 Switching Characteristics — Serial Control Port - SPI Master Mode 1.5.17 Switching Characteristics — Serial Control Port - SPI Master Mode 1.5.18 Switching Characteristics — Serial Control Port - SPI Master Mode 1.5.19 Switching Characteristics — Serial Control Port - SPI Master Mode 1.5.19 Switching Characteristics — Serial Control Port - SPI Master Mode 1.5.11 Switching Characteristics — Serial Control Port - SPI Master Mode 1.5.11 Switching Characteristics — Seri			
4.2.2 Digital Audio Output Port (DAO) 4.2.3 Serial Control Port 1 & 2 (I²C® or SPI™) 4.2.4 External Memory Interface 4.2.5 GPIO. 4.2.6 PLL-based Clock Generator 4.3 DSP I/O Description 4.3.1 Multiplexed Pins 4.3.2 Termination Requirements 4.3.3 Pads 4.4.4 Application Code Security 5. Characteristics and Specifications 11 5.1 Absolute Maximum Ratings 1.5.2 Recommended Operating Conditions 5.3 Digital DC Characteristics 1.5.5 Thermal Data (128-Pin LQFP) 1.5.6 Switching Characteristics — RESET 1.5.7 Switching Characteristics — XTI 5.8 Switching Characteristics — Serial Control Port - SPI Slave Mode 1.5.10 Switching Characteristics — Serial Control Port - SPI Master Mode 1.5.12 Switching Characteristics — Serial Control Port - I²C Slave Mode 1.5.12 Switching Characteristics — Serial Control Port - I²C Slave Mode 1.5.13 Switching Characteristics — Serial Control Port - I²C Master Mode 1.5.14 Switching Characteristics — Serial Control Port - I²C Master Mode 1.5.15 Switching Characteristics — Serial Control Port - I²C Master Mode 1.5.14 Switching Characteristics — Serial Control Port - I²C Master Mode 1.5.14 Switching Characteristics — Serial Control Port - I²C Master Mode 1.5.15 Switching Characteristics — Serial Control Port - I²C Master Mode 1.5.14 Switching Characteristics — Serial Control Port - I²C Master Mode 1.5.14 Switching Characteristics — Serial Control Port - I²C Master Mode 1.5.15 Switching Characteristics — Digital Audio Slave Input Port 1.5.15 Switching Characteristics — Digital Audio Slave Input Port 1.5.16 Switching Characteristics — Solater Mode 1.7. Environmental, Manufacturing, and Handling Information 2.7. Environmental, Manufacturing, and Handling Information 2.8. Device Pin-Out Diagram 2.9. Package Mechanical Drawings 2.9. Package Mechanical Drawings 2.9. Package Mechanical Drawings 2.9. Package Mechanical Drawings		·	
4.2.3 Serial Control Port 1 & 2 ((² C [©] or SPI [™]) 4.2.4 External Memory Interface 4.2.5 GPIO 4.2.6 PLL-based Clock Generator 4.3 DSP I/O Description 4.3.1 Multiplexed Pins 4.3.2 Termination Requirements 4.3.3 Pads 4.4 Application Code Security 5. Characteristics and Specifications 11 5.1 Absolute Maximum Ratings 5.2 Recommended Operating Conditions 5.3 Digital DC Characteristics 1.5.5 Thermal Data (128-Pin LQFP) 5.6 Switching Characteristics — RESET 5.7 Switching Characteristics — Internal Clock 5.9 Switching Characteristics — Internal Clock 5.9 Switching Characteristics — Serial Control Port - SPI Slave Mode 1.5.10 Switching Characteristics — Serial Control Port - SPI Master Mode 1.5.11 Switching Characteristics — Serial Control Port - I ² C Slave Mode 1.5.12 Switching Characteristics — Serial Control Port - I ² C Slave Mode 1.5.13 Switching Characteristics — Serial Control Port - I ² C Slave Mode 1.5.14 Switching Characteristics — Serial Control Port - I ² C Slave Mode 1.5.15 Switching Characteristics — Serial Control Port - I ² C Slave Mode 1.5.14 Switching Characteristics — Serial Control Port - I ² C Slave Mode 1.5.15 Switching Characteristics — Digital Audio Slave Input Port 5.15 Switching Characteristics — Digital Audio Slave Input Port 5.16 Switching Characteristics — Digital Audio Slave Input Port 5.15 Switching Characteristics — Digital Audio Output Port 5.16 Switching Characteristics — Digital Audio Output Port 5.17 Environmental, Manufacturing, and Handling Information 20 8. Device Pin-Out Diagram 21 8. Device Pin-Out Diagram 22 9. Package Mechanical Drawings 22 9. Package Mechanical Drawings		• • • • • • • • • • • • • • • • • • • •	
4.2.4 External Memory Interface 4.2.5 PID 4.2.6 PLL-based Clock Generator 4.3 DSP I/O Description 4.3.1 Multiplexed Pins 4.3.2 Fermination Requirements 4.3.3 Pads 4.4 Application Code Security 5. Characteristics and Specifications 5.1 Absolute Maximum Ratings 5.2 Recommended Operating Conditions 5.3 Digital DC Characteristics 5.4 Power Supply Characteristics 5.5 Thermal Data (128-Pin LQFP) 5.6 Switching Characteristics— RESET 5.7 Switching Characteristics— RESET 5.9 Switching Characteristics— Serial Control Port - SPI Slave Mode 5.9 Switching Characteristics— Serial Control Port - SPI Master Mode 5.11 Switching Characteristics— Serial Control Port - SPI Master Mode 5.11 Switching Characteristics— Serial Control Port - I ² C Slave Mode 5.11 Switching Characteristics— Serial Control Port - I ² C Master Mode 5.13 Switching Characteristics— Digital Audio Slave Input Port 5.14 Switching Characteristics— Digital Audio Output Port 5.15 Switching Characteristics— Digital Audio Output Port 5.16 Switching Characteristics— SDRAM Interface 6. Ordering Information 7. Environmental, Manufacturing, and Handling Information		4.2.3 Serial Control Port 1.8.2 ($1^2C^{\mathbb{R}}$ or SPI^{TM})	٥
4.2.5 GPIO 4.2.6 PILL-based Clock Generator 4.3 DSP I/O Description 4.3.1 Multiplexed Pins 4.3.2 Termination Requirements 4.3.2 Termination Requirements 4.3.3 Pads 4.4 Application Code Security 5. Characteristics and Specifications 11 5.1 Absolute Maximum Ratings 11 5.2 Recommended Operating Conditions 11 5.3 Digital DC Characteristics 11 5.4 Power Supply Characteristics 15 5.5 Thermal Data (128-Pin LQFP) 15 6 Switching Characteristics—RESET 17 5.7 Switching Characteristics—RESET 18 5.8 Switching Characteristics—Internal Clock 19 5.9 Switching Characteristics—Serial Control Port - SPI Slave Mode 10 5.10 Switching Characteristics—Serial Control Port - SPI Master Mode 11 5.11 Switching Characteristics—Serial Control Port - P ² C Slave Mode 11 5.12 Switching Characteristics—Serial Control Port - P ² C Master Mode 11 5.13 Switching Characteristics—Serial Control Port - P ² C Master Mode 11 5.14 Switching Characteristics—UART 15 5.14 Switching Characteristics—UaRT 15 5.15 Switching Characteristics—Digital Audio Slave Input Port 15 5.16 Switching Characteristics—Digital Audio Output Port 20 5.16 Switching Characteristics—Sprak Interface 21 6. Ordering Information 22 6. Ordering Information 22 7. Environmental, Manufacturing, and Handling Information 22 8. Device Pin-Out Diagram 24 8. 128-Pin LQFP Pin-Out Diagram 25 9. Package Mechanical Drawings 26 9. Package Mechanical Drawings 27 9. Package Mechanical Drawings 26		· · · · · · · · · · · · · · · · · · ·	
4.2.6 PLL-based Clock Generator 4.3 DSP I/O Description 4.3.1 Multiplexed Pins 4.3.2 Termination Requirements 4.3.3 Pads 4.4 Application Code Security 5. Characteristics and Specifications 10 5.1 Absolute Maximum Ratings 5.2 Recommended Operating Conditions 5.3 Digital DC Characteristics 5.4 Power Supply Characteristics 5.5 Thermal Data (128-Pin LQFP) 5.6 Switching Characteristics— RESET 5.7 Switching Characteristics— RESET 5.8 Switching Characteristics — Serial Control Port - SPI Slave Mode 5.10 Switching Characteristics — Serial Control Port - SPI Master Mode 5.11 Switching Characteristics — Serial Control Port - I ² C Slave Mode 5.11 Switching Characteristics — Serial Control Port - I ² C Master Mode 5.12 Switching Characteristics — UART 5.13 Switching Characteristics — Digital Audio Slave Input Port 5.14 Switching Characteristics — Digital Audio Output Port 5.15 Switching Characteristics — SDRAM Interface 6. Ordering Information 22 7. Environmental, Manufacturing, and Handling Information 22 8. Device Pin-Out Diagram 26 8. Package Mechanical Drawings 29 <		·	
4.3 DSP I/O Description 4.3.1 Multiplexed Pins 4.3.2 Termination Requirements 4.3.3 Pads 4.4 Application Code Security 5. Characteristics and Specifications 10 5.1 Absolute Maximum Ratings 5.2 Recommended Operating Conditions 11 5.3 Digital DC Characteristics 11 5.4 Power Supply Characteristics 11 5.5 Thermal Data (128-Pin LQFP) 12 5.6 Switching Characteristics—RESET 13 5.7 Switching Characteristics—RESET 15.8 Switching Characteristics—Internal Clock 15.9 Switching Characteristics—Serial Control Port - SPI Slave Mode 15.10 Switching Characteristics—Serial Control Port - SPI Master Mode 15.11 Switching Characteristics—Serial Control Port - I ² C Slave Mode 15.12 Switching Characteristics—Serial Control Port - I ² C Master Mode 15.13 Switching Characteristics—Digital Audio Slave Input Port 15.15 Switching Characteristics—Digital Audio Slave Input Port 15.15 Switching Characteristics—Digital Audio Slave Input Port 15.16 Switching Characteristics—Digital Audio Slave Input Port 15.16 Switching Characteristics—Digital Audio Slave Input Port 25.16 Switching Characteristics—Digital Audio Slave Input Port 25.16 Switching Characteristics—Digital Audio Slave Input Port 26. Ordering Information 27. Environmental, Manufacturing, and Handling Information 28. Device Pin-Out Diagram 29. Package Mechanical Drawings 29. 128-Pin LQFP Pin-Out Diagram 20 20 21 2128-Pin LQFP Package 22			
4.3.1 Multiplexed Pins 4.3.2 Termination Requirements 4.3.3 Pads 4.4 Application Code Security 5. Characteristics and Specifications 5.1 Absolute Maximum Ratings 11 5.2 Recommended Operating Conditions 1 5.3 Digital DC Characteristics 1 5.4 Power Supply Characteristics 1 5.5 Thermal Data (128-Pin LQFP) 1 5.6 Switching Characteristics— RESET 1 5.7 Switching Characteristics— XTI 1 5.8 Switching Characteristics— Serial Control Port - SPI Slave Mode 1 5.10 Switching Characteristics— Serial Control Port - SPI Master Mode 1 5.11 Switching Characteristics— Serial Control Port - I ² C Slave Mode 1 5.13 Switching Characteristics— Serial Control Port - I ² C Master Mode 1 5.13 Switching Characteristics— Digital Audio Slave Input Port 1 5.15 Switching Characteristics— Digital Audio Slave Input Port 1 5.16 Switching Characteristics— Digital Audio Slave Input Port 2 5.16 Switching Characteristics— Digital Audio Slave Input Port 2 5.16 Switching Characteristics— Digital Audio Slave Input Port 2 5.16 Switching Characteristics— Serial Control Port - PC Master M			
4.3.2 Termination Requirements 4.3.3 Pads 4.4 Application Code Security 5. Characteristics and Specifications 10 5.1 Absolute Maximum Ratings 11 5.2 Recommended Operating Conditions 11 5.3 Digital DC Characteristics 11 5.4 Power Supply Characteristics 11 5.5 Thermal Data (128-Pin LQFP) 12 5.6 Switching Characteristics—RESET 13 5.7 Switching Characteristics—RESET 14 5.8 Switching Characteristics—Internal Clock 15 5.9 Switching Characteristics—Serial Control Port - SPI Slave Mode 15 5.10 Switching Characteristics—Serial Control Port - SPI Master Mode 15 5.11 Switching Characteristics—Serial Control Port - I ² C Slave Mode 15 5.12 Switching Characteristics—Serial Control Port - I ² C Master Mode 15 5.13 Switching Characteristics—Serial Control Port - I ² C Master Mode 15 5.14 Switching Characteristics—UART 15 5.14 Switching Characteristics—Digital Audio Slave Input Port 15 5.15 Switching Characteristics—Digital Audio Output Port 20 5.16 Switching Characteristics—Spigital Audio Output Port 21 5.16 Switching Characteristics—Spigital Audio Output Port 22 5.16 Switching Characteristics—Spigital Audio Output Port 23 6. Ordering Information 24 7. Environmental, Manufacturing, and Handling Information 25 8. Device Pin-Out Diagram 26 8. 128-Pin LQFP Pin-Out Diagram 27 9. Package Mechanical Drawings 29 9. 128-Pin LQFP Package			
4.4 Application Code Security 5. Characteristics and Specifications 5.1 Absolute Maximum Ratings 5.2 Recommended Operating Conditions 5.3 Digital DC Characteristics 15.4 Power Supply Characteristics 5.5 Thermal Data (128-Pin LQFP) 5.6 Switching Characteristics—RESET 5.7 Switching Characteristics—RESET 5.8 Switching Characteristics—Serial Control Port - SPI Slave Mode 5.10 Switching Characteristics—Serial Control Port - SPI Master Mode 5.11 Switching Characteristics—Serial Control Port - I ² C Slave Mode 5.12 Switching Characteristics—Serial Control Port - I ² C Master Mode 15.13 Switching Characteristics—Serial Control Port - I ² C Master Mode 15.14 Switching Characteristics—Serial Control Port - I ² C Master Mode 15.15 Switching Characteristics—Dart 5.14 Switching Characteristics—Digital Audio Slave Input Port 5.15 Switching Characteristics—Digital Audio Slave Input Port 5.16 Switching Characteristics—Digital Audio Output Port 5.16 Switching Characteristics—Sor Digital Audio Output Port 5.16 Switching Characteristics—Sor Digital Audio Doubut Port 5.16 Switching Characteristics—Sor Digital Audio Slave Input Port 5.16 Switching Characteristics—Sor Digital Audio Slave Input Port 5.16 Switching Characteristics—Sor Digital Audio Slave Input Port 5.17 Environmental, Manufacturing, and Handling Information 22 32. Environmental, Manufacturing, and Handling Information 23. Device Pin-Out Diagram 24. Survey Pin-Out Diagram 25. Package Mechanical Drawings 26. Package Mechanical Drawings 27. Package Mechanical Drawings 28. Package Mechanical Drawings 29. Package Mechanical Drawings		·	
4.4 Application Code Security 10 5. Characteristics and Specifications 10 5.1 Absolute Maximum Ratings 11 5.2 Recommended Operating Conditions 11 5.3 Digital DC Characteristics 11 5.4 Power Supply Characteristics 1 5.5 Thermal Data (128-Pin LQFP) 1 5.6 Switching Characteristics—RESET 1 5.7 Switching Characteristics—XTI 1 5.8 Switching Characteristics—Internal Clock 1 5.9 Switching Characteristics—Serial Control Port - SPI Slave Mode 1 5.10 Switching Characteristics—Serial Control Port - SPI Master Mode 1 5.11 Switching Characteristics—Serial Control Port - I ² C Slave Mode 1 5.12 Switching Characteristics—Serial Control Port - I ² C Master Mode 1 5.13 Switching Characteristics—UART 1 5.14 Switching Characteristics—Digital Audio Slave Input Port 1 5.15 Switching Characteristics—Digital Audio Output Port 2 5.16 Switching Characteristics—SDRAM Interface 2 6. Ordering Information 2 7. Environmental, Manufacturing, and Handling Information 2 8. Device Pin-Out Diagram 2 8.1 128		·	
5. Characteristics and Specifications 10 5.1 Absolute Maximum Ratings 11 5.2 Recommended Operating Conditions 10 5.3 Digital DC Characteristics 11 5.4 Power Supply Characteristics 1 5.5 Thermal Data (128-Pin LQFP) 1 5.6 Switching Characteristics— RESET 11 5.7 Switching Characteristics— XTI 1 5.8 Switching Characteristics— Internal Clock 1 5.9 Switching Characteristics— Serial Control Port - SPI Slave Mode 1 5.10 Switching Characteristics— Serial Control Port - SPI Master Mode 1 5.11 Switching Characteristics— Serial Control Port - I ² C Slave Mode 1 5.12 Switching Characteristics— Serial Control Port - I ² C Master Mode 1 5.13 Switching Characteristics— UART 1 5.14 Switching Characteristics— Digital Audio Slave Input Port 1 5.15 Switching Characteristics— Digital Audio Output Port 2 5.16 Switching Characteristics— SDRAM Interface 2 6. Ordering Information 2 7. Environmental, Manufacturing, and Handling Information 2 8. Device Pin-Out Diagram 2 8.1 128-Pin LQFP Pin-Out Diagram 2			
5.1 Absolute Maximum Ratings	5		
5.2 Recommended Operating Conditions 5.3 Digital DC Characteristics 5.4 Power Supply Characteristics 15.5 Thermal Data (128-Pin LQFP) 15.6 Switching Characteristics—RESET 5.7 Switching Characteristics—RESET 5.8 Switching Characteristics—Internal Clock 15.9 Switching Characteristics—Serial Control Port - SPI Slave Mode 5.10 Switching Characteristics—Serial Control Port - SPI Master Mode 15.11 Switching Characteristics—Serial Control Port - PC Slave Mode 16.12 Switching Characteristics—Serial Control Port - PC Slave Mode 17.13 Switching Characteristics—Serial Control Port - PC Slave Mode 18.14 Switching Characteristics—UART 19.14 Switching Characteristics—Digital Audio Slave Input Port 19.15 Switching Characteristics—Digital Audio Output Port 19.16 Switching Characteristics—Spidal Audio Output Port 19.16 Switching Characteristics—Spidal Audio Output Port 19.17 Environmental, Manufacturing, and Handling Information 20.17 Environmental, Manufacturing, and Handling Information 21.18 Device Pin-Out Diagram 22.19 Package Mechanical Drawings 23.11 28-Pin LQFP Package 24.128-Pin LQFP Package 25.11 28-Pin LQFP Package 26.128-Pin LQFP Package 27.128-Pin LQFP Package 28.128-Pin LQFP Package 29.11 28-Pin LQFP Package	٥.	•	
5.3 Digital DC Characteristics 10 5.4 Power Supply Characteristics 11 5.5 Thermal Data (128-Pin LQFP) 11 5.6 Switching Characteristics— RESET 11 5.7 Switching Characteristics— RESET 11 5.8 Switching Characteristics— Internal Clock 11 5.9 Switching Characteristics— Internal Clock 11 5.9 Switching Characteristics— Serial Control Port - SPI Slave Mode 11 5.10 Switching Characteristics— Serial Control Port - SPI Master Mode 11 5.11 Switching Characteristics— Serial Control Port - I ² C Slave Mode 11 5.12 Switching Characteristics— Serial Control Port - I ² C Master Mode 11 5.13 Switching Characteristics— UART 15.14 Switching Characteristics— UART 15.15 Switching Characteristics— Digital Audio Slave Input Port 15.15 Switching Characteristics— Digital Audio Output Port 15.16 Switching Characteristics— SDRAM Interface 12 5.16 Switching Characteristics— SDRAM Interface 12 5.17 Environmental, Manufacturing, and Handling Information 12 5.18 Pin LQFP Pin-Out Diagram 12 8.1 128-Pin LQFP Pin-Out Diagram 12 9.1 Package Mechanical Drawings 12 9.1 128-Pin LQFP Package 12		<u> </u>	
5.4 Power Supply Characteristics 1 5.5 Thermal Data (128-Pin LQFP) 1 5.6 Switching Characteristics — RESET 1 5.7 Switching Characteristics — XTI 1 5.8 Switching Characteristics — Internal Clock 1 5.9 Switching Characteristics — Serial Control Port - SPI Slave Mode 1 5.10 Switching Characteristics — Serial Control Port - SPI Master Mode 1 5.11 Switching Characteristics — Serial Control Port - I ² C Slave Mode 1 5.12 Switching Characteristics — Serial Control Port - I ² C Master Mode 1 5.13 Switching Characteristics — Serial Control Port - I ² C Master Mode 1 5.14 Switching Characteristics — UART 1 5.14 Switching Characteristics — Digital Audio Slave Input Port 1 5.15 Switching Characteristics — Digital Audio Output Port 1 5.16 Switching Characteristics — SDRAM Interface 1 6. Ordering Information 2 7. Environmental, Manufacturing, and Handling Information 2 8. Device Pin-Out Diagram 2 8.1 128-Pin LQFP Pin-Out Diagram 2 9. Package Mechanical Drawings 2 9.1 128-Pin LQFP Package 2 2			
5.5 Thermal Data (128-Pin LQFP) 5.6 Switching Characteristics — RESET 5.7 Switching Characteristics — XTI 5.8 Switching Characteristics — Internal Clock 5.9 Switching Characteristics — Serial Control Port - SPI Slave Mode 5.10 Switching Characteristics — Serial Control Port - SPI Master Mode 5.11 Switching Characteristics — Serial Control Port - I ² C Slave Mode 5.12 Switching Characteristics — Serial Control Port - I ² C Master Mode 5.13 Switching Characteristics — Serial Control Port - I ² C Master Mode 5.14 Switching Characteristics — UART 5.14 Switching Characteristics — Digital Audio Slave Input Port 5.15 Switching Characteristics — Digital Audio Output Port 5.16 Switching Characteristics — SDRAM Interface 6. Ordering Information 7. Environmental, Manufacturing, and Handling Information 22 8.1 128-Pin LQFP Pin-Out Diagram 24 8.7 Package Mechanical Drawings 9.1 128-Pin LQFP Package 25 26 27 28 29 20 20 20 20 20 20 20 20 20			
5.7 Switching Characteristics — XTI 5.8 Switching Characteristics — Internal Clock 5.9 Switching Characteristics — Serial Control Port - SPI Slave Mode 5.10 Switching Characteristics — Serial Control Port - SPI Master Mode 5.11 Switching Characteristics — Serial Control Port - I ² C Slave Mode 5.12 Switching Characteristics — Serial Control Port - I ² C Master Mode 5.13 Switching Characteristics — Serial Control Port - I ² C Master Mode 5.14 Switching Characteristics — UART 5.14 Switching Characteristics — Digital Audio Slave Input Port 5.15 Switching Characteristics — Digital Audio Output Port 5.16 Switching Characteristics — SDRAM Interface 6. Ordering Information 7. Environmental, Manufacturing, and Handling Information 2. Substitution Control Diagram 8.1 128-Pin LQFP Pin-Out Diagram 8.1 128-Pin LQFP Pin-Out Diagram 9. Package Mechanical Drawings 9.1 128-Pin LQFP Package			
5.8 Switching Characteristics — Internal Clock		5.6 Switching Characteristics— RESET	12
5.9 Switching Characteristics — Serial Control Port - SPI Slave Mode 5.10 Switching Characteristics — Serial Control Port - SPI Master Mode 5.11 Switching Characteristics — Serial Control Port - I ² C Slave Mode 5.12 Switching Characteristics — Serial Control Port - I ² C Master Mode 5.13 Switching Characteristics — Serial Control Port - I ² C Master Mode 5.14 Switching Characteristics — UART 5.15 Switching Characteristics — Digital Audio Slave Input Port 5.15 Switching Characteristics — Digital Audio Output Port 5.16 Switching Characteristics — SDRAM Interface 6. Ordering Information 7. Environmental, Manufacturing, and Handling Information 8. Device Pin-Out Diagram 8.1 128-Pin LQFP Pin-Out Diagram 9. Package Mechanical Drawings 9.1 128-Pin LQFP Package 22			
5.10 Switching Characteristics — Serial Control Port - SPI Master Mode			
5.11 Switching Characteristics — Serial Control Port - I ² C Slave Mode			
5.12 Switching Characteristics — Serial Control Port - I ² C Master Mode			
5.13 Switching Characteristics — UART			
5.14 Switching Characteristics — Digital Audio Slave Input Port 5.15 Switching Characteristics — Digital Audio Output Port 5.16 Switching Characteristics — SDRAM Interface 6. Ordering Information 7. Environmental, Manufacturing, and Handling Information 8. Device Pin-Out Diagram 8.1 128-Pin LQFP Pin-Out Diagram 9. Package Mechanical Drawings 9.1 128-Pin LQFP Package			
5.15 Switching Characteristics — Digital Audio Output Port 5.16 Switching Characteristics — SDRAM Interface 6. Ordering Information 7. Environmental, Manufacturing, and Handling Information 8. Device Pin-Out Diagram 8.1 128-Pin LQFP Pin-Out Diagram 9. Package Mechanical Drawings 9.1 128-Pin LQFP Package			
5.16 Switching Characteristics — SDRAM Interface			
6. Ordering Information			
7. Environmental, Manufacturing, and Handling Information	6	· · · · · · · · · · · · · · · · · · ·	
8. Device Pin-Out Diagram		_	
8.1 128-Pin LQFP Pin-Out Diagram			
9. Package Mechanical Drawings29 9.1 128-Pin LQFP Package29	წ.		
9.1 128-Pin LQFP Package29			
-	9.		
10. Revision History30		9.1 128-Pin LQFP Package	29
	10	0. Revision History	30



List of Figures

Figure 1. RESET Timing	12
Figure 2. XTI Timing	13
Figure 3. Serial Control Port - SPI Slave Mode Timing	14
Figure 4. Serial Control Port - SPI Master Mode Timing	15
Figure 5. Serial Control Port - I ² C Slave Mode Timing	
Figure 6. Serial Control Port - I ² C Master Mode Timing	
Figure 7. UART Timing	
Figure 8. Digital Audio Input (DAI) Port Timing Diagram	
Figure 9. Digital Audio Port Timing Master Mode	20
Figure 10. Digital Audio Output Timing, Slave Mode (Relationship LRCLK to SCLK)	21
Figure 11. External Memory Interface - SDRAM Burst Read Cycle	23
Figure 12. External Memory Interface - SDRAM Burst Write Cycle	24
Figure 13. External Memory Interface - SDRAM Auto Refresh Cycle	25
Figure 14. External Memory Interface - SDRAM Load Mode Register Cycle	26
Figure 15. 128-Pin LQFP Pin-Out	
Figure 16. 128-Pin LQFP Package Drawing	
List of Tables	
Table 1. CS49DV8C Related Documentation	5
Table 2. Device and Firmware Selection Guide	
Table 3. CS49DV8C DSP Memory Sizes	7
Table 4. Ordering Information	27
Table 5. Environmental, Manufacturing, and Handling Information	27
Table 6, 128-Pin LQFP Package Characteristics	29



1. Documentation Strategy

The CS49DV8C data sheet describes the CS49DV8C family of multichannel audio DSPs. This document should be used in conjunction with the following documents when evaluating or designing a system around the CS49DV8C family of processors.

Table 1. CS49DV8C Related Documentation

Document Name	Description
CS49DV8C Data Sheet	This document
CS4953xx Hardware User's Manual	Detailed system design information including Typical Connection Diagrams, boot-procedures, pin descriptions, and other system configuration information.
AN288PPH, "Dolby [®] Volume Module"	Application note contains an Application Programming Interface (API) used to control the Dolby Volume firmware.
DSP Composer [™] User's Manual	Includes detailed configuration and usage information for the GUI development tool.

The scope of the *CS49DV8C Data Sheet* is primarily the hardware specifications of the CS49DV8C devices. This includes hardware functionality, characteristic data, pinout, and packaging information.

The intended audience for the *CS49DV8C Data Sheet* is the system PCB designer, MCU programmer, and the quality control engineer.

2. Overview

The CS49DV8C DSP is designed to provide high-performance volume control using the Dolby Volume algorithm. The CS49DV8, supports up to 7.1 Channels of Dolby Volume processing at 48 kHz, 44.1 kHz or 32 kHz while leaving the 2nd core of the DSP completely available for even further processing functions such as Quadruple Crossover Bass Management, Tone Control, and Multiband Parametric EQ.

The CS49DV8C DSP, together with Cirrus Logic's comprehensive library of audio processing algorithms, enables the development of next-generation high-definition audio solutions. Cirrus Logic also provides a broad array of digital interface products, and audio converters, to meet your audio system-level design requirements.

The CS49DV8C is available in a 128-pin LQFP package.

Please refer to Table 2 on page 6 for the processor speed and available firmware for the CS49DV8C product family.

Table 2. Device and Firmware Selection Guide

Device	Pre- Process	Decode Processor A ¹	Mid-processor A ¹	Mid-processor B ¹	Post-processor ¹
CS49DV8C 300 MIPS	None	Stereo PCM Multi-Channel PCM (2:1 Downsampling Option) (4:1 Downsampling Option)	Dolby [®] Volume (Runs on either DSP A or B) See Section 3. for additional concurrency information.	Dolby [®] Volume (Runs on either DSP A or B) See Section 3. for additional concurrency information.	 Tone Control Re-EQ PEQ (up to 11 bands) Delay 7.1 Bass Manager Audio Manager 1:2 Upsampling

^{1.} Processing may be restricted and dependent on firmware selected. Contact your Cirrus Logic FAE for concurrency matrix.



2.1 Licensing

Licenses are required for Dolby Volume and for all of the third party audio processing algorithms. Please contact your local Cirrus Sales representative for more information.

3. Firmware Supported

The suite of software available for the CS49DV8C family consists of operating systems (OS) and a library of overlays. The overlays have been divided into three main groups called Decoders, Midprocessors, and Post-processors. All software components are defined as follows:

- OS/Kernel Encompasses all non-audio processing tasks, including loading data from external memory, processing host messages, calling audio-processing subroutines, auto-detection, error concealment, etc.
- Dolby Volume The CS49DV8C can run Dolby Volume on either DSP A or DSP B. On the DSP that
 is not running Dolby Volume, it can run the firmware currently available on the CS4953xx family for
 that DSP (A or B).

4. Hardware Functional Description

4.1 DSP Core

The CS49DV8C is a dual-core DSP with separate X and Y data and P code memory spaces. Each core is a high-performance, 32-bit, user-programmable, fixed-point DSP that is capable of performing two memory access control (MAC) operations per clock cycle. Each core has eight 72-bit accumulators, four X- and four Y-data registers, and 12 index registers.

Both DSP cores are coupled to a flexible DMA engine. The DMA engine can move data between peripherals such as the digital audio input (DAI) and digital audio output (DAO), external memory, or any DSP core memory, all without the intervention of the DSP. The DMA engine offloads data move instructions from the DSP core, leaving more MIPS available for signal processing instructions.

CS49DV8C functionality is controlled by application codes that are stored in on-board ROM or downloaded to the CS49DV8C from a host MCU or external FLASH/EEPROM. Users can choose to use standard audio post-processor modules which are available from Cirrus Logic.

4.1.1 DSP Memory

The memory maps for the DSPs are as follows. All memory sizes are composed of 32-bit words.

 Memory Type
 DSP A
 DSP B

 X
 16k SRAM, 32k ROM
 10k SRAM, 8k ROM

 Y
 24k SRAM, 32k ROM
 16k SRAM, 16k ROM

 P
 8k SRAM, 32k ROM
 8k SRAM, 24k ROM

Table 3. CS49DV8C DSP Memory Sizes

4.1.2 DMA Controller

The powerful 12-channel DMA controller can move data between 8 on-chip resources. Each resource has its own arbiter: X, Y, and P RAM/ROMs on DSP A; X, Y, and P RAM/ROMs on DSP B; external



memory; and the peripheral bus. Modulo and linear addressing modes are supported, with flexible start address and increment controls. The service interval for each DMA channel as well as up to 6 interrupt events, is programmable.

4.2 On-chip DSP Peripherals

4.2.1 Digital Audio Input Port (DAI)

The 12-channel (6 line) DAI port supports a wide variety of data input formats. The port is capable of accepting PCM or IEC61937. Up to 32-bit word lengths are supported. Additionally support is provided for audio data input to the DSP via the DAI from an HDMI receiver.

The port has two independent slave-only clock domains. Each data input can be independently assigned to a clock domain. The sample rate of the input clock domains can be determined automatically by the DSP, which off-loads the task of monitoring the SPDIF receiver from the host. A time-stamping feature allows the input data to be sample-rate converted via software.

4.2.2 Digital Audio Output Port (DAO)

There are two DAO ports. Each port can output 8 channels of up to 32-bit PCM data. The port supports data rates from 32 kHz to 192 kHz. Each port can be configured as an independent clock domain in slave mode, or the ratio of the two clocks can be set to even multiples of each other in master mode. The two ports can also be ganged together into a single clock domain. Each port has one serial audio pin that can be configured as a 192 kHz SPDIF transmitter (data with embedded clock on a single line).

4.2.3 Serial Control Port 1 & 2 (I²C[®] or SPI[™])

There are two on-chip serial control ports that are capable of operating as master or slave in either I²C or SPI modes. SCP1 defaults to slave operation. It is dedicated for external host-control and supports an external clock up to 25MHz in SPI mode. This high clock speed enables very fast code download, control or data delivery. SCP2 defaults to master mode and is dedicated for booting from external serial Flash memory or for audio sub-system control.

4.2.4 External Memory Interface

The external memory interface controller supports up to 128 Mbits of SDRAM, using a 16-bit data bus.

4.2.5 **GPIO**

Many of the CS49DV8C peripheral pins are multiplexed with GPIO. Each GPIO can be configured as an output, an input, or an input with interrupt. Each input-pin interrupt can be configured as rising edge, falling edge, active-low, or active-high.

4.2.6 PLL-based Clock Generator

The low-jitter PLL generates integer or fractional multiples of a reference frequency which are used to clock the DSP core and peripherals. Through a second PLL divider chain, a dependent clock domain can be output on the DAO port for driving audio converters. The CS49DV8C defaults to running from the external reference frequency and can be switched to use the PLL output after overlays have been loaded and configured, either through master boot from an external FLASH or through host control. A built-in crystal oscillator circuit with a buffered output is provided. The buffered output frequency ratio is selectable between 1:1 (default) or 2:1.



4.3 DSP I/O Description

4.3.1 Multiplexed Pins

Many of the CS49DV8C pins are multi-functional. For details on pin functionality please refer to the CS4953xx Hardware User's Manual.

4.3.2 Termination Requirements

Open-drain pins on the CS49DV8C must be pulled high for proper operation. Please refer to the CS4953xx Hardware User's Manual to identify which pins are open-drain and what value of pull-up resistor is required for proper operation.

Mode select pins on the CS49DV8C are used to select the boot mode upon the rising edge of reset. A detailed explanation of termination requirements for each communication mode select pin can be found in the CS4953xx Hardware User's Manual.

4.3.3 Pads

The CS49DV8C I/O operates from the 3.3 V supply and is 5 V tolerant.

4.4 Application Code Security

The external program code may be encrypted by the programmer to protect any intellectual property it may contain. A secret, customer-specific key is used to encrypt the program code that is to be stored external to the device.



5. Characteristics and Specifications

Note: All data sheet minimum and maximum timing parameters are guaranteed over the rated voltage and temperature. All data sheet typical parameters are measured under the following conditions: T = 25 °C, C_L = 20 pF, VDD = 1.8 V, VDDA = VDDIO = 3.3 V, GNDD = GNDIO = GNDA = 0 V.

5.1 Absolute Maximum Ratings

(GNDD = GNDIO = GNDA = 0 V; all voltages with respect to 0 V)

Parameter		Symbol	Min	Max	Unit
DC power supplies:	Core supply	VDD	-0.3	2.0	V
	PLL supply	VDDA	-0.3	3.6	V
	I/O supply	VDDIO	-0.3	3.6	V
	VDDA-VDDIO		-	0.3	V
Input pin current, any pin except supplies		I _{in}	-	+/- 10	mA
Input voltage on PLL_REF_RES		V _{filt}	-0.3	3.6	V
Input voltage on I/O pins		V _{inio}	-0.3	5.0	V
Storage temperature		T _{stg}	-65	150	°C

Caution: Operation at or beyond these limits may result in permanent damage to the device. Normal operation is not guaranteed at these extremes.

5.2 Recommended Operating Conditions

(GNDD = GNDIO = GNDA = 0 V; all voltages with respect to 0 V)

Parameter	Symbol	Min	Тур	Max	Unit
DC power supplies: Core supply	VDD	1.71	1.8	1.89	V
PLL supply	VDDA	3.13	3.3	3.46	V
I/O supply	VDDIO	3.13	3.3	3.46	V
VDDA – VDDIO			0		V
Ambient operating temperature	T _A				
Commercial Grade (CVZ/CVZR)		0	+25	+ 70	°C

Note: It is recommended that the 3.3 V IO supply come up ahead of or simultaneously with the 1.8 V core supply.

5.3 Digital DC Characteristics

(Measurements performed under static conditions.)

Parameter	Symbol	Min	Тур	Max	Unit
High-level input voltage	V_{IH}	2.0	-	-	V
Low-level input voltage, except XTI	V_{IL}	-	-	0.8	V
Low-level input voltage, XTI	V_{ILXTI}	-	-	0.6	V
Input Hysteresis	V_{hys}		0.4		V
High-level output voltage ($I_O = -4mA$), except XTI, SDRAM pins	V _{OH}	VDDIO * 0.9	-	-	V
Low-level output voltage (I _O = 4mA), except XTI, SDRAM pins	V _{OL}	-	-	VDDIO * 0.1	V
SDRAM High-level output voltage (I _O = -8mA)	V _{OH}	VDDIO * 0.9	-	-	V
SDRAM Low-level output voltage (I _O = 8mA)	V _{OL}	-	-	VDDIO * 0.1	V
Input leakage current (all digital pins with internal pull-up resistors disabled)	I _{IN}	-	-	5	μΑ



Parameter	Symbol	Min	Тур	Max	Unit
Input leakage current (all digital pins with internal pull-up resistors enabled, and XTI)	I _{IN-PU}	-	-	50	μΑ

5.4 Power Supply Characteristics

(Measurements performed under operating conditions.)

Parameter	Min	Тур	Max	Unit
Power supply current:				
Core and I/O operating: VDD ¹	-	500	-	mA
PLL operating: VDDA	-	3.5	-	mA
With external memory and most ports operating: VDDIO	-	120	-	mA

^{1.}Dependent on application firmware and DSP clock speed.

5.5 Thermal Data (128-Pin LQFP)

Parameter	Symbol	Min	Тур	Max	Unit
Thermal Resistance (Junction to Ambient)	θ_{ia}				°C / Watt
Two-layer Board ¹		-	48	-	
Four-layer Board ²		-	40	-	
Thermal Resistance (Junction to Top of Package)	ψ_{it}				°C / Watt
Two-layer Board ¹		-	.39	-	
Four-layer Board ²		-	.33	-	

- **Notes:** 1.Two-layer board is specified as a 76 mm X 114 mm, 1.6 mm thick FR-4 material with 1-oz copper covering 20% of the top and bottom layers.
 - 2. Four-layer board is specified as a 76 mm X 114 mm, 1.6 mm thick FR-4 material with 1-oz copper covering 20% of the top and bottom layers and 0.5-oz copper covering 90% of the internal power plane and ground plane layers.
 - 3. To calculate the die temperature for a given power dissipation T_{i} = Ambient Temperature + [(Power Dissipation in Watts) * θ_{ia}]
 - 4. To calculate the case temperature for a given power dissipation
 - $T_c = T_i$ [(Power Dissipation in Watts) * ψ_{it}]



5.6 Switching Characteristics— RESET

Parameter	Symbol	Min	Max	Unit
RESET minimum pulse width low	T _{rstl}	1	-	μs
All bidirectional pins high-Z after RESET low	T _{rst2z}	-	100	ns
Configuration pins setup before RESET high	T _{rstsu}	50	-	ns
Configuration pins hold after RESET high	T _{rsthld}	20	-	ns

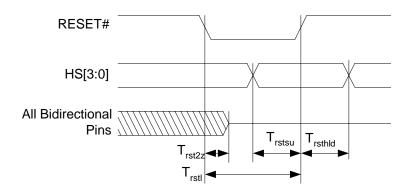


Figure 1. RESET Timing



5.7 Switching Characteristics — XTI

Parameter	Symbol	Min	Max	Unit
External Crystal operating frequency ¹	F _{xtal}	11.2896	27	MHz
XTI period	T _{clki}	33.3	100	ns
XTI high time	T _{clkih}	13.3	-	ns
XTI low time	T _{clkil}	13.3	-	ns
External Crystal Load Capacitance (parallel resonant) ²	CL	10	18	pF
External Crystal Equivalent Series Resistance	ESR		50	W

- 1. Part characterized with the following crystal frequency values: 11.2896, 12.288, 18.432, 24.576, and 27 MHz.
- C_L refers to the total load capacitance as specified by the crystal manufacturer. Crystals which require a
 C_L outside this range should be avoided. The crystal oscillator circuit design should follow the crystal
 manufacturer's recommendation for load capacitor selection.

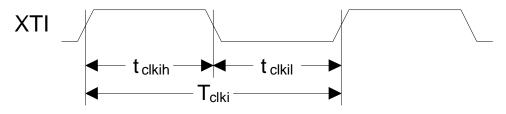


Figure 2. XTI Timing

5.8 Switching Characteristics — Internal Clock

Parameter	Symbol	Min	Max	Unit
Internal DCLK frequency ¹	F _{dclk}			MHz
CS49DV8C-CVZ		F _{xtal}	150	
CS49DV8C-CVZR				
Internal DCLK period ¹	DCLKP			ns
CS49DV8C-CVZ		6.7	1/F _{xtal}	
CS49DV8C-CVZR			7.62.	

^{1.}After initial power-on reset, $F_{dclk} = F_{xtal}$. After initial kickstart commands, the PLL is locked to max F_{dclk} and remains locked until the next power-on reset.



5.9 Switching Characteristics — Serial Control Port - SPI Slave Mode

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Parameter	Symbol	Min	Typical	Max	Units
SCP_CLK frequency ¹	f _{spisck}	-		25	MHz
SCP_CS falling to SCP_CLK rising	t _{spicss}	24		-	ns
SCP_CLK low time	t _{spickl}	20		-	ns
SCP_CLK high time	t _{spickh}	20		-	ns
Setup time SCP_MOSI input	t _{spidsu}	5		-	ns
Hold time SCP_MOSI input	t _{spidh}	5		-	ns
SCP_CLK low to SCP_MISO output valid	t _{spidov}	-		11	ns
SCP_CLK falling to SCP_IRQ rising	t _{spiirqh}	-		20	ns
SCP_CS rising to SCP_IRQ falling	t _{spiirql}	0			ns
SCP_CLK low to SCP_CS rising	t _{spicsh}	24		-	ns
SCP_CS rising to SCP_MISO output high-Z	t _{spicsdz}	-	20		ns
SCP_CLK rising to SCP_BSY falling	t _{spicbsyl}	-	3*DCLKP+20		ns

The specification f_{spisck} indicates the maximum speed of the hardware. The system designer should be aware that the
actual maximum speed of the communication port may be limited by the firmware application. Flow control using the
SCP_BSY pin should be implemented to prevent overflow of the input data buffer. At boot the maximum speed is
Fxtal/3.

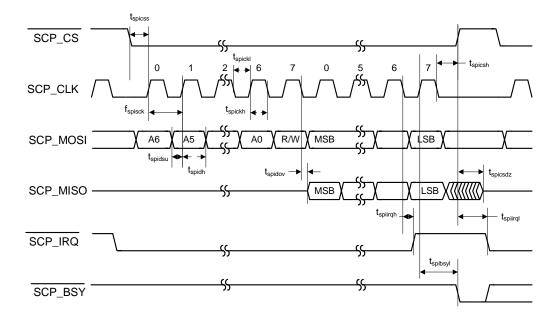


Figure 3. Serial Control Port - SPI Slave Mode Timing



5.10 Switching Characteristics — Serial Control Port - SPI Master Mode

Parameter	Symbol	Min	Typical	Max	Units
SCP_CLK frequency ¹	f _{spisck}	-		F _{xtal} /2 (See Footnote 2)	MHz
SCP_CS falling to SCP_CLK rising ³	t _{spicss}	-	11*DCLKP + (SCP_CLK PERIOD)/2	-	ns
SCP_CLK low time	t _{spickl}	18		-	ns
SCP_CLK high time	t _{spickh}	18		-	ns
Setup time SCP_MISO input	t _{spidsu}	11		-	ns
Hold time SCP_MISO input	t _{spidh}	5		-	ns
SCP_CLK low to SCP_MOSI output valid	t _{spidov}	-		11	ns
SCP_CLK low to SCP_CS falling	t _{spicsl}	7		-	ns
SCP_CLK low to SCP_CS rising	t _{spicsh}	-	11*DCLKP + (SCP_CLK PERIOD)/2	-	ns
Bus free time between active SCP_CS	t _{spicsx}		3*DCLKP	-	ns
SCP_CLK falling to SCP_MOSI output high-Z	t _{spidz}	-		20	ns

- 1. The specification f_{spisck} indicates the maximum speed of the hardware. The system designer should be aware that the actual maximum speed of the communication port may be limited by the firmware application.
- 2. See Section 5.7.
- 3. SCP_CLK PERIOD refers to the period of SCP_CLK as being used in a given application. It does not refer to a tested parameter.

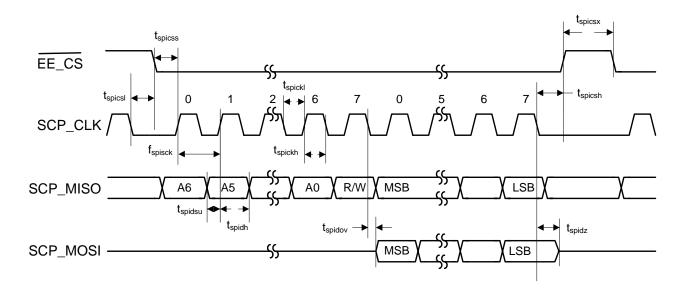


Figure 4. Serial Control Port - SPI Master Mode Timing



5.11 Switching Characteristics — Serial Control Port - I²C Slave Mode

Parameter	Symbol	Min	Typical	Max	Units
SCP_CLK frequency ¹	f _{iicck}	-		400	kHz
SCP_CLK low time	t _{iicckl}	1.25		-	μs
SCP_CLK high time	t _{iicckh}	1.25		-	μs
SCP_SCK rising to SCP_SDA rising or falling for START or STOP condition		1.25			μs
START condition to SCP_CLK falling	t _{iicstscl}	1.25		-	μs
SCP_CLK falling to STOP condition	t _{iicstp}	2.5		-	μs
Bus free time between STOP and START conditions	t _{iicbft}	3		-	μs
Setup time SCP_SDA input valid to SCP_CLK rising	t _{iicsu}	100			ns
Hold time SCP_SDA input after SCP_CLK falling	t _{iich}	20		-	ns
SCP_CLK low to SCP_SDA out valid	t _{iicdov}	-		18	ns
SCP_CLK falling to SCP_IRQ rising	t _{iicirqh}	-		3*DCLKP + 40	ns
NAK condition to SCP_IRQ low	t _{iicirql}		3*DCLKP + 20		ns
SCP_CLK rising to SCB_BSY low	t _{iicbsyl}	ı	3*DCLKP + 20		ns

The specification f_{iicck} indicates the maximum speed of the hardware. The system designer should be aware that the actual maximum speed of the communication port may be limited by the firmware application. Flow control using the SCP_BSY pin should be implemented to prevent overflow of the input data buffer.

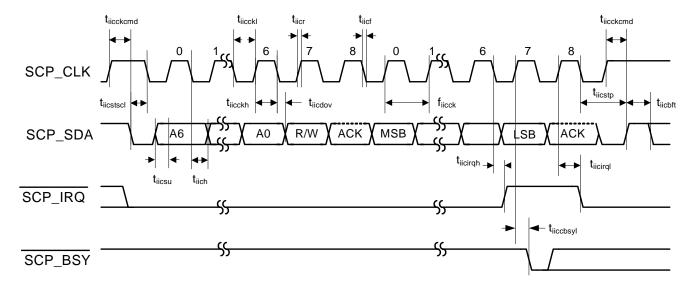


Figure 5. Serial Control Port - I²C Slave Mode Timing



5.12 Switching Characteristics — Serial Control Port - I²C Master Mode

Parameter	Symbol	Min	Max	Units
SCP_CLK frequency ¹	f _{iicck}	-	400	kHz
SCP_CLK low time	t _{iicckl}	1.25	-	μs
SCP_CLK high time	t _{iicckh}	1.25	-	μs
SCP_SCK rising to SCP_SDA rising or falling for START or STOP condition	t _{iicckcmd}	1.25		μs
START condition to SCP_CLK falling	t _{iicstscl}	1.25	-	μs
SCP_CLK falling to STOP condition	t _{iicstp}	2.5	-	μs
Bus free time between STOP and START conditions	t _{iicbft}	3	-	μs
Setup time SCP_SDA input valid to SCP_CLK rising	t _{iicsu}	100		ns
Hold time SCP_SDA input after SCP_CLK falling	t _{iich}	20	-	ns
SCP_CLK low to SCP_SDA out valid	t _{iicdov}	-	18	ns

^{1.} The specification f_{iicck} indicates the maximum speed of the hardware. The system designer should be aware that the actual maximum speed of the communication port may be limited by the firmware application.

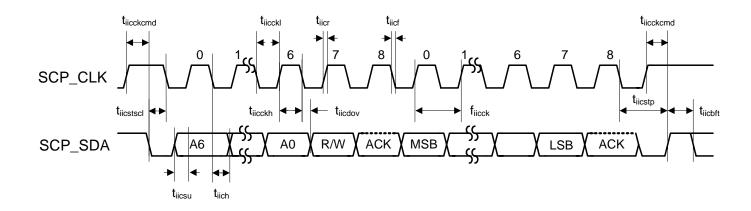


Figure 6. Serial Control Port - I²C Master Mode Timing



5.13 Switching Characteristics — UART

Parameter	Symbol	Min	Max	Unit
UART_CLK period ¹	t _{uclki}	266	-	ns
UART_CLK duty cycle	-	40	60	%
Setup time for UART_RXD	t _{uckrxsu}	5	-	
Hold time for UART_RXD	t _{uckrxdv}	5	-	ns
Delay from CLK transition to TXD transition	t _{ucktxdv}	-	29	ns

^{1.} The minimum clock period is limited to DCLKP/32 or the minimum value, whichever is larger.

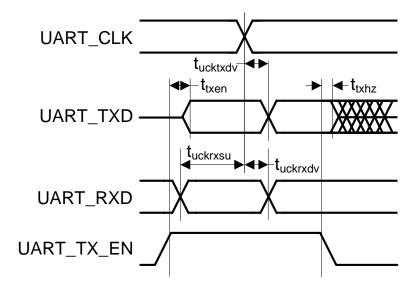


Figure 7. UART Timing



5.14 Switching Characteristics — Digital Audio Slave Input Port

Parameter	Symbol	Min	Max	Unit
DAI_SCLK period	T _{daiclkp}	40	-	ns
DAI_SCLK duty cycle	-	45	55	%
Setup time DAI_DATAn	t _{daidsu}	10	-	ns
Hold time DAI_DATAn	t _{daidh}	5	-	ns

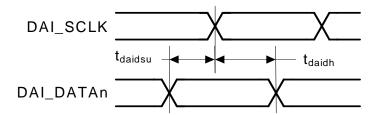


Figure 8. Digital Audio Input (DAI) Port Timing Diagram

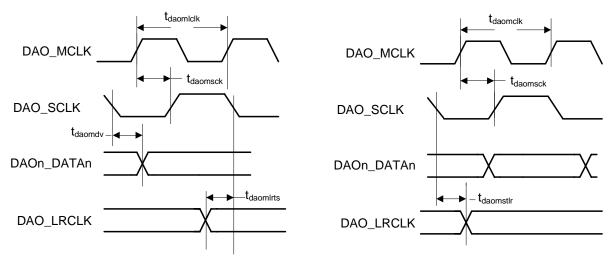


5.15 Switching Characteristics — Digital Audio Output Port

Parameter	Symbol	Min	Max	Unit
DAO_MCLK period	T _{daomclk}	40	-	ns
DAO_MCLK duty cycle	-	45	55	%
DAO_SCLK period for Master or Slave mode ¹	T _{daosclk}	40	-	ns
DAO_SCLK duty cycle for Master or Slave mode ¹	-	40	60	%
Master Mode (Output A1 Mode) ^{1,2}				
DAO_SCLK delay from DAO_MCLK rising edge,	t _{daomsck}	-	19	ns
DAO_MCLK as an input				
DAO_LRCLK delay from DAO_SCLK transition, respectively ³	t _{daomstlr}	-	8	ns
DAO_SCLK delay from DAO_LRCLK transition, respectively ³	t _{daomlrts}	-	8	ns
DAO1_DATA[30], DAO2_DATA[10] delay from DAO_SCLK transition ³	t _{daomdv}	-	10	ns
Slave Mode (Output A0 Mode) ⁴				
DAO1_DATA[30], DAO2_DATA[10] delay from DAO_SCLK transition ³	t _{daosdv}	-	15	ns
DAO_LRCLK delay from DAO_SCLK transition, respectively ³	t _{daosstlr}	-	30	ns
DAO_SCLK delay from DAO_LRCLK transition, respectively ³	t _{daosIrts}	-	15	ns

^{1.}Master mode timing specifications are characterized, not production tested.

^{4.} Slave mode is defined as DAO_SCLK, DAO_LRCLK driven by an external source.



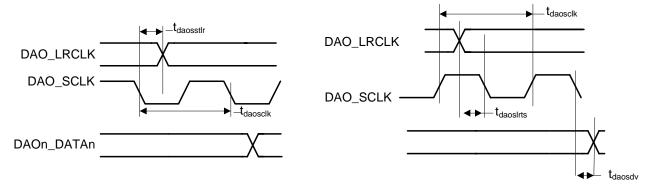
Note: In these diagrams, Falling edge is the inactive edge of DAO_SCLK

Figure 9. Digital Audio Port Timing Master Mode

^{2.}Master mode is defined as the CS49DVxx driving both DAO_SCLK, DAO_LRCLK. When MCLK is an input, it is divided to produce DAO_SCLK, DAO_LRCLK.

^{3.} This timing parameter is defined from the non-active edge of DAO_SCLK. The active edge of DAO_SCLK is the point at which the data is valid.





Note: In these diagrams, Falling edge is the inactive edge of DAO_SCLK

Figure 10. Digital Audio Output Timing, Slave Mode (Relationship LRCLK to SCLK)



5.16 Switching Characteristics — SDRAM Interface

Refer to Figure 11 through Figure 14.

(SD_CLKOUT = SD_CLKIN)

Parameter	Symbol	Min	Typical	Max	Unit
SD_CLKIN high time	t _{sdclkh}	2.3		-	ns
SD_CLKIN low time	t _{sdclkl}	2.3		-	ns
SD_CLKOUT rise/fall time	t _{sdclkrf}	-		1	ns
SD_CLKOUT Frequency			150		MHz
SD_CLKOUT duty cycle	-	45		55	%
SD_CLKOUT rising edge to signal valid	t _{sdcmdv}	-		3.8	ns
Signal hold from SD_CLKOUT rising edge	t _{sdcmdh}		1.1	-	ns
SD_CLKOUT rising edge to SD_DQMn valid	t _{sddqv}	-	3.8	-	ns
SD_DQMn hold from SD_CLKOUT rising edge	t _{sddqh}	1.38		-	ns
SD_DATA valid setup to SD_CLKIN rising edge	t _{sddsu}	1.3		-	ns
SD_DATA valid hold to SD_CLKIN rising edge	t _{sddh}	1.38		-	ns
SD_CLKOUT rising edge to ADDRn valid	t _{sdav}	-	3.8	-	ns

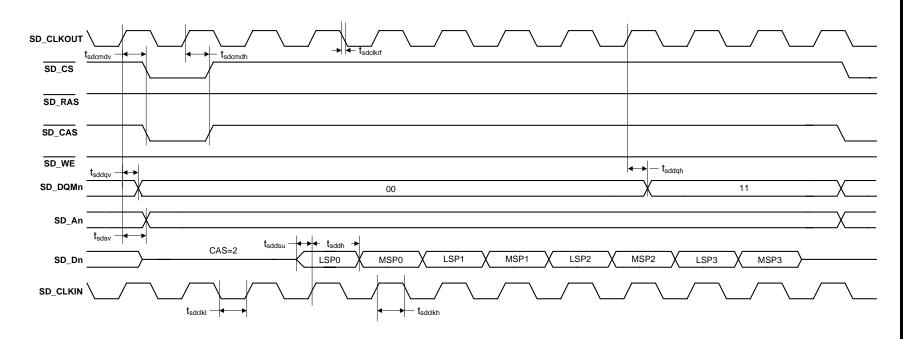


Figure 11. External Memory Interface - SDRAM Burst Read Cycle

SD_DQMn

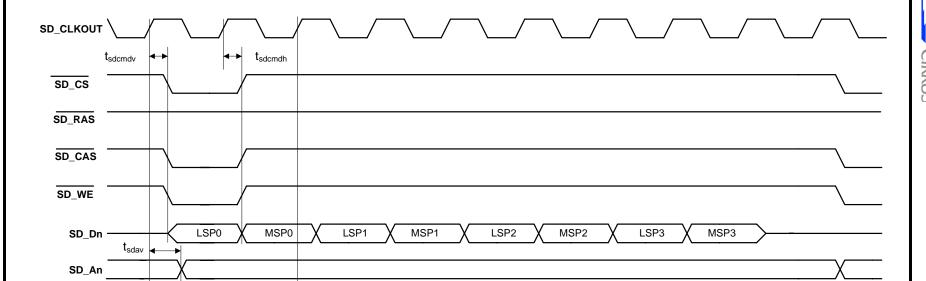


Figure 12. External Memory Interface - SDRAM Burst Write Cycle

11

00

 t_{sddqv}

→ t_{sddqh}

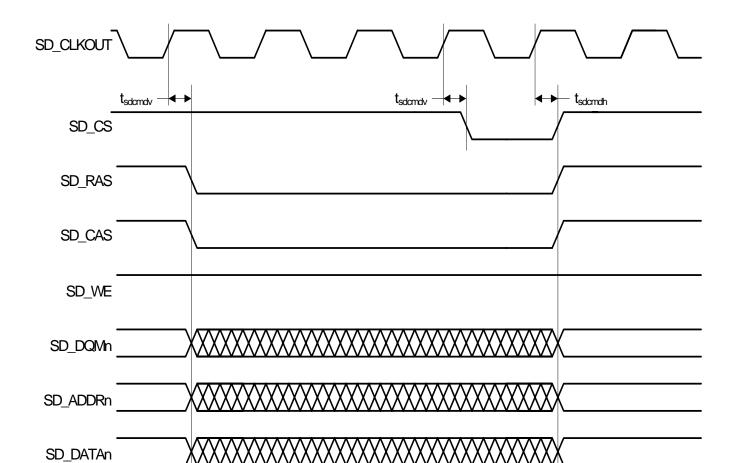


Figure 13. External Memory Interface - SDRAM Auto Refresh Cycle

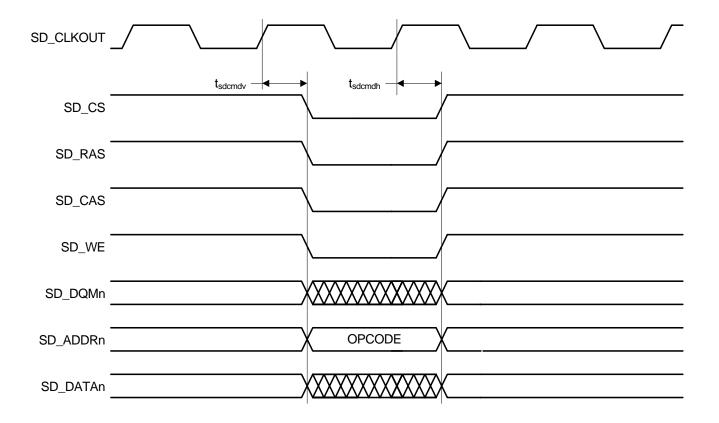


Figure 14. External Memory Interface - SDRAM Load Mode Register Cycle



6. Ordering Information

The CS49DV8C family part number is described as follows:

CS49DVNNI-XYZ

where

NN - Product Number Variant

I - ROM ID Number

x - Product Grade

Y - Package Type

z - Lead (Pb) Free

Table 4. Ordering Information

Part No.	Part No. Grade		Container	Package
CS49DV8C-CVZ	Commercial	0 to +70 °C	Tray	128-pin LQFP
CS49DV8C-CVZR	Commercial	0 to +70 °C	Reel	120-piii LQFF

7. Environmental, Manufacturing, and Handling Information

Table 5. Environmental, Manufacturing, and Handling Information

Model Number	Peak Reflow Temp	MSL Rating*	Max Floor Life
CS49DV8C-CVZ	260 °C	3	7 Days
CS49DV8C-CVZR	260 °C	3	7 Days

^{*} MSL (Moisture Sensitivity Level) as specified by IPC/JEDEC J-STD-020.



8. Device Pin-Out Diagram

8.1 128-Pin LQFP Pin-Out Diagram

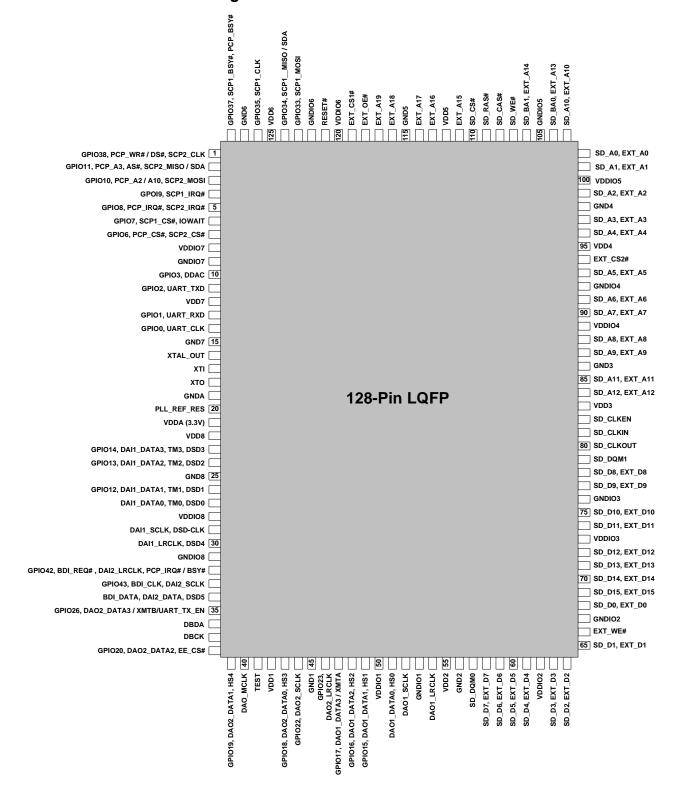


Figure 15. 128-Pin LQFP Pin-Out



9. Package Mechanical Drawings

9.1 128-Pin LQFP Package

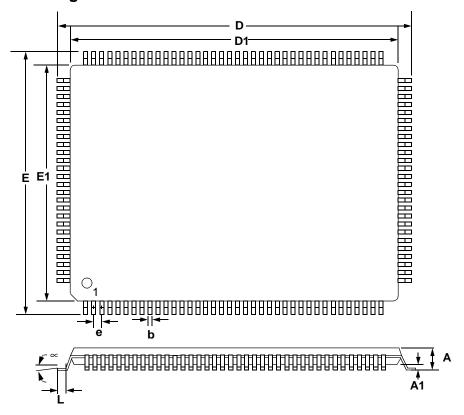


Figure 16. 128-Pin LQFP Package Drawing

Table 6. 128-Pin LQFP Package Characteristics

DIM		MILLIMETERS			INCHES			
DIW	MIN	NOM	MAX	MIN	NOM	MAX		
A			1.60			.063"		
A1	0.05		0.15	.002"		.006"		
b	0.17	0.22	0.27	.007"	.009"	.011"		
D		22.00 BSC			.866"			
D1		20.00 BSC		.787"				
E		16.00 BSC		.630"				
E1		14.00 BSC		.551"				
е		0.50 BSC		.020"				
q	0°	3.5	7°	0°	3.5	7°		
L	0.45	0.60	0.75	.018"	.024"	.030"		
L1	1.00 REF			.039" REF				
TOLERANCES OF FORM AND POSITION								
ddd	0.08				.003"			



10. Revision History

Revision	Date	Changes
PP1	September 2, 2008	Initial Release.
PP2	September 25, 2008	Removed references to External Parallel Flash / SRAM Interface.